vectors

Semantics 3, UCLA Linguistics

Spring 2022

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1 this week's goals

- why do we need plural degrees / intervals?
- why do we need vectors?
- considerations for collapsing the two

2 plural degrees

- we've looked at plural degrees already:

(1) A is tall.
  a. $[\![\text{tall}]\!] = \lambda d \lambda x.\text{tall}(x) \geq d$
  b. $[\![\text{A is tall}]\!] = \{d : \text{tall}(x) \geq d\}$

  - (why do we want to use this meaning, and thereby have plural degrees?)

- some people have argued that intervals or plural degrees should be the primary primitive (Schwarzschild and Wilkinson, 2002; Dotlacil and Nouwen, 2016)[1]

  - (the same goes for times... why would that be?)

- another consideration: recall that Cresswell (1976) needed to stipulate that degrees were shorthand for a pair consisting of a point and an ordering; we don't need to do this if there are no single(ton) degrees

3 vectors

- OG vector guys: Zwarts (1997); Zwarts and Winter (2000)
- three types of motivating data:

1. modified PPs (Zwarts, 1997)

(2) a. one meter behind the desk
  b. far outside the village
  c. right under the lamp

2. directional prepositions denote paths, not locations (Zwarts, 1997)

(3) a. B walked towards the square.
  b. B walked (away) from the square.

[1] I'm glossing over the difference between intervals and plural degrees here! Let me know if you care about it.

3. locative prepositions also invoke (relations between) vector space (Zwarts and Winter, 2000)[2]

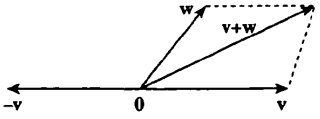
   (4) The house is outside France. → The house is outside Paris.

- let's do our usual morphological tests for how legit we think vectors are as a primitive
- a glimpse of the formalism:

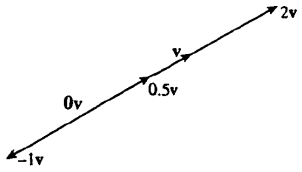
(23) A vector space **V** over the set of real numbers R is a set that is closed under two operations:
   a. *Vector addition*
      For every pair **v**, **w** ∈ **V** there is exactly one **v** + **w** ∈ **V**, the *vector sum* of **v** and **w**
   b. *Scalar multiplication*
      For every **v** ∈ **V** and s ∈ R there is exactly one s**v** ∈ **V**, the *scalar product* of **v** by scalar s

The operations of vector addition and scalar multiplication are graphically illustrated in (24) and (25), respectively:

(24) *Vector addition*

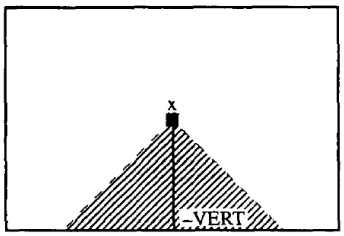


(25) *Scalar multiplication*

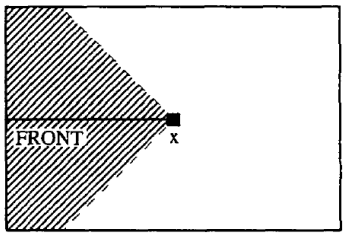


(5) $[\![\text{two meters PP}]\!] = \{v \in [\![\text{PP}]\!] : |v| = 2\text{m}\}$

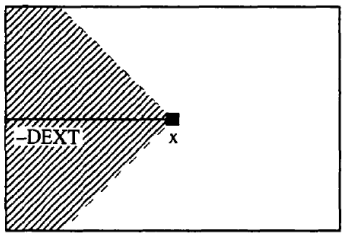
(53) *onder x (front view)*



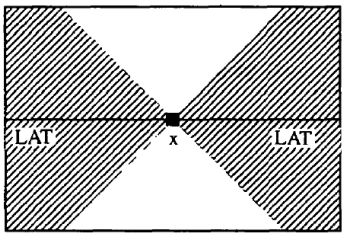
(54) *voor x (side view)*



(55) *links van x (front view)*



(56) *naast (front view)*



4 the Schwarzschild Syncretism

- recall that traditional semantic accounts of comparatives don't assign *than* meaning (Schwarzschild, 2008)
  - languages differ wrt what their comparative subordinator looks like..

[2] Bonus: these relations can be characterized as upward- and downward-monotonic, and license NPIs accordingly (Zwarts and Winter, 2000).

- ... but they're often case markers or adpositions, and often spatial adpositions (Stassen, 1985)

- but Schwarzschild (2012, 2013) shows a compelling cross-domain syncretism:

(6) Hindi
  a. anu raaj **se** lambii hai
  Anu Raj FROM tall.FEM PRES.SG
  'Anu is taller than Raj.'
  b. anu us baRe kamre **se** niklii
  Anu that.OBL big.OBL FROM come.out.PERF.FEM
  'Anu came out of that big room.'

(7) Navajo (see also Bogal-Allbritten, 2013)
  a. Shizhé'é shi**lááh** 'ánílnéézz
  1SG-father 1SG.O-BEYOND 'á$_{CA}$-ní$_{CA}$-3S-l$_{valence}$-tall$_{CA}$
  'My father is taller than I am.'
  b. Shizhé'é shi**'oh** 'ánílnéézz
  1SG-father 1SGO-UNDER 'á$_{CA}$-ní$_{CA}$-3S-l$_{valence}$-tall$_{CA}$
  'My father is less tall than me.'

- the account, informally:
  - it would be a mistake to argue that *se* is doing the directional work in (6-a), that's something we want a comparative morpheme to do[3]
  - a helpful analogy:

(8) a. Jack ran from the room.
  b. Jack left the room quickly.

    * in (8-a) the verb describes the motion, the PP the starting point; they conspire to describe a path
    * in (8-b) the verb describes the path and marks the object as a starting point

  - the adposition *se* marks a starting point, and leaves the rest of the path up to the rest of the sentence
  - *se* clauses are thus analyzed as "directed scale segments"

- formal ingredients:
  - "A directed segment is a segment of a line that has directionality" (2012:66).

(9) Let σ be a **directed scale segment** where: $\sigma = \langle s, e, \prec_\sigma \rangle$
  $\textsc{start}(\sigma) = s \quad \nearrow(\sigma)$ iff $s \prec_\sigma e$
  $\textsc{end}(\sigma) = e \quad \searrow(\sigma)$ iff $e \prec_\sigma s$

  - (a scale is a relation between pairs)

- a compositional analysis:

(10) a. $[\![\text{from Raj}]\!] = \lambda P \exists \sigma \nearrow(\sigma) \wedge \textsc{start}(\sigma) = \text{Raj} \wedge P(\sigma)$
  b. $[\![\text{tall}]\!] = \lambda\sigma\lambda x.\textsc{end}(\sigma) = x \wedge \prec_\sigma = \text{height}$
  c. $[\![\text{Anu from Raj tall}]\!] = \exists\sigma \nearrow(\sigma) \wedge \textsc{start}(\sigma) = \text{Raj} \wedge \textsc{end}(\sigma) = \text{Anu} \wedge \prec_\sigma = \text{height}$
  'There is a rising segment of the height scale that begins with Raj and ends with Anu.'

[3] "According to nearly every current semantic analysis, scalar notions are present in comparatives regardless of how the standard is marked" (2012:66).

- with measure phrases:

(11) anu raaj se **do inc** lambii hai.
Anu Raj FROM 2 inch tall.FEM be.PRES.SG
'Anu is 2 inches taller than Raj.'

(12) $[\![\text{2 inch}]\!] = \lambda R \lambda \sigma \lambda x . R(\sigma)(x) \wedge 2''(\sigma)$

(13) $[\![(11)]\!] = \exists \sigma \nearrow (\sigma) \wedge \textsc{start}(\sigma) = \text{Raj} \wedge \textsc{end}(\sigma) = \text{Anu} \wedge \prec_\sigma = \text{height} \wedge 2''(\sigma)$

- 'less' comparatives are formed with a morpheme analyzed as a scale inverse operator

(14) ye g^h us g^{h}ar se (do saal) kam puraanaa hai
this house that.OBL house FROM (two year) little old.M be.PRES.SG
'This house is (2 years) less old than that house is.'

(15) $[\![\text{kam}]\!] = \lambda R \lambda \sigma \lambda x . \textsc{end}(\sigma) = x \wedge \exists \sigma' R(\sigma')(x) \wedge \prec_\sigma = \textsc{inverse}(\prec_{\sigma'})$

- a big challenge, for Schwarzschild's analysis, is where the comparative meaning comes from in these languages in which the comparative only overtly marks a starting point[4]
  - how does he do this?
  - does English have this option?

- another challenge: "complex gradables"

(16) anu-ne raaj-se garam cai banaaii
Anu-*erg* Raj-FROM hot tea make.PFV.FEM
'Anu made hotter tea than Raj made.'

- see Schwarzschild (2013) for a directed-scale-segment-based treatment of English comparatives (p215) and some arguments for and against a neo-Kleinian approach to comparatives

references

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[4] From Schwarzschild (2013) p233-4: "When I first read about Navajo comparatives in Bogal-Allbritten (2008), I was puzzled by how much of the meat of comparison could be sandwiched inside an adjunct. I'd become accustomed to thinking of the standard and the comparative marker as central elements of the comparative. In fact, differentials in English already show more flexibility than I was allowing for... differentials can appear inside adverbial PPs following the rest of the clause: *The bowl is heavier than any of the glasses were, by at least 2 grams*."